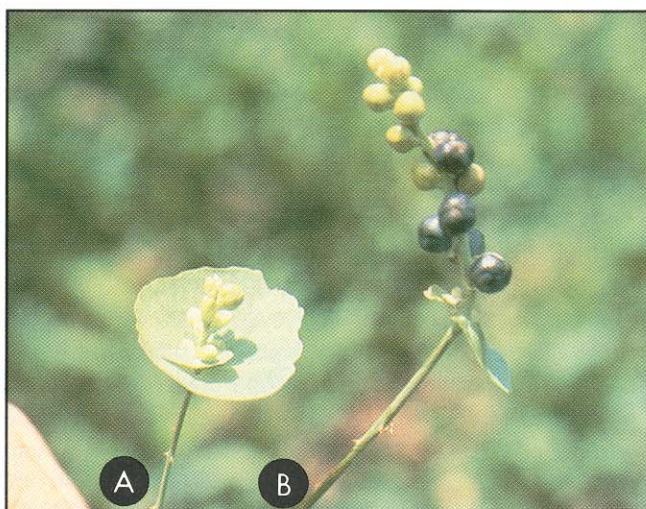
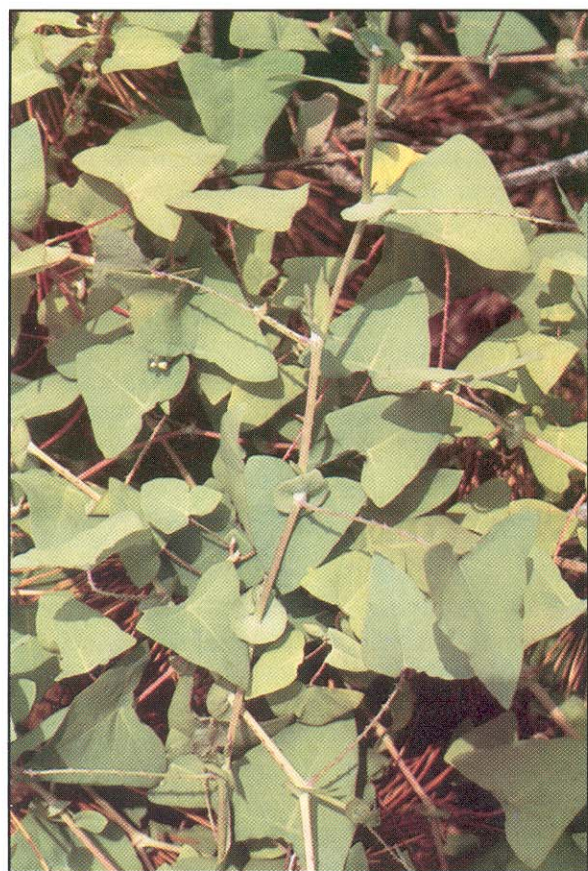


## *Polygonum perfoliatum* L. (POLYGONACEAE), the Mile-a-minute Weed<sup>1</sup>

J. Douglas Oliver<sup>2</sup> and Nancy C. Coile<sup>3</sup>

**INTRODUCTION:** *Polygonum perfoliatum* L. grows so rapidly and thickly that it is called the "mile-a-minute weed." Other common names include "minute weed", "tearthumb", and in Japan, "ishimi-kawa" (Ohwi 1965) or "shimakawa" (Cusick and Ortt 1987). Tearthumb is a common name used for several species of *Polygonum* and refers to the prickles on the stems and leaves which can tear thumbs and fingers of the unwary. This exotic species has become established in Pennsylvania and Maryland. It is starting to replace native vegetation, and is on the move southward. Kartesz (1994) provides one synonym: *Ampelygonum perfoliatum* (L.) Roberty & Vautier; others include: *Tracaulon perfoliatum* (L.) Greene (Reed 1979a and 1979b) and *Persicaria perfoliatum* (L.) Greene (Cusick and Ortt 1987).

So far, this weed has not been found in Florida. However, a look at the spread of *P. perfoliatum* in the United States and knowledge about the origin of *P. perfoliatum* may forewarn us of the risk that this weed poses for the southeastern U.S.



**Fig. 1 (left).** Vining habit of *Polygonum perfoliatum*. Note prickles on stems and lower surface of leaves.

**Fig. 2 (above).** (A) Saucer-shaped ochrea and (B) bluish infructescence. Finger in lower left provides size scale.

Photography credits: Larry H. McCormick, Pennsylvania State University.

<sup>1</sup> Contribution No. 30, Bureau of Entomology, Nematology and Plant Pathology - Botany Section.

<sup>2</sup> Biologist, Florida Department of Environmental Protection, Bureau of Mine Reclamation, Tallahassee, FL 32310.

<sup>3</sup> Botanist, FDACS, Division of Plant Industry, P.O. Box 147100, Gainesville, FL 32614-7100.



**DISTRIBUTION:** Mile-a-minute weed is native to Japan, Korea, China, Taiwan, the Malay Peninsula, India (Ohwi 1965, Reed 1977), and Bangladesh (Kahn and Hassan 1978) and has been recorded from Turkey (Guner 1984). The first record in the U.S. is a single specimen in Gray Herbarium at Harvard University dated 1890 and taken from boat ballast near Portland, Oregon (Hickman and Hickman 1977). Hill *et al.* 1981 cite its presence in British Columbia, Canada in 1954. Since 1954, there have been no records of *P. perfoliatum* west of the Rocky Mountains in North America.

In the East, the story is not as pleasant. The earliest record is a 1946 collection from an orchard in York County, Pennsylvania. These plants probably originated from rhododendron nursery stock imported from eastern Asia in the 1930s (Hill *et al.* 1981). By 1979, *P. perfoliatum* was established in six counties in Maryland (Riefner and Windler 1979). The weed continued to spread southward, and by 1981, *P. perfoliatum* was in West Virginia (Dupstadt 1981), then Virginia (Bradley 1983), the District of Columbia (Cusick 1986), and in southern Delaware and New Jersey (N. Hartwig, personal communication).

The first edition (1963) of Gleason and Cronquist's manual of the northeastern US flora did not contain *P. perfoliatum*. However, the 2nd edition (1991) cites establishment in Pennsylvania, Maryland, and West Virginia and indicates that the species is "expected to spread." With the ability to outcompete much of the native flora and the prickly nature of the plants, this pest species' movement southward could cause it to become a great problem in the southeastern U.S. The climates of the southeastern U.S. and Southeast Asia have many similarities, and a plant whose origin is Southeast Asia might well be expected to thrive in the southeastern U.S. Primary means of distribution are likely transport by avian migration, movement of contaminated soil (*e.g.*, with potted plants or on machinery), and by hay. When machinery travels over tangled mats of *P. perfoliatum*, the plants can wrap around axles and actually impede movement (R. Westbrook, personal communication).

**DESCRIPTION:** *Polygonum perfoliatum* is an annual scandent herb with elongated, branched stems to 2 m long. Fagan Johnson (personal communication) has seen plants clambering up to 12 feet in pine trees. Stems are slender, have short retrorse prickles and, when in the sun, may be reddish. Leaves are alternate, simple, triangular, 2.5-7.5 cm (1-3 inches) long and wide; the base is truncate, but with a peltate attachment to the petiole. Leaves are glabrous except for retrorse prickles on the underside of the leaves, especially on the mid-vein and the vein at the base of the leaf (Fig. 1). Petioles are as long as leaf blades and have retrorse prickles. Ocrea (nodal sheaths which arise from fusion of stipules) are a diagnostic feature of *Polygonum*. Rather than the usual tubular and chartaceous ocrea, these flare widely into a saucer shape and appear leaf-like (Fig 2). The upper leaves are represented by the foliaceous ocrea.

The perianth parts are greenish-white, 3-4 mm long (ca. 1/16 inch) and at maturity thicken, become metallic-blue and 5 mm (ca. 1/8 inch) wide and long. Inside the mature perianth is the single, shiny, hard, black, nearly round fruit (an achene) which is ca. 3 mm wide and long. When heated in a microwave oven, the achenes will expand like popcorn (R. Young, personal communication). The flowers and fruits are arranged in spike-like racemes to 2 cm long, subtended by a leaf-like bract (Fig. 2). In fruit, the spike looks like an odd, iridescent-blue blackberry.

**MAY BE CONFUSED WITH** three native species of *Polygonum* in the southeastern United States which have retrorse prickles: *P. sagittatum* L., *P. arifolium* L. and *P. meisnerianum* Cham. & Schlecht. var. *beyrichianum* (Cham. & Schlecht.) Meisn. in Mart. (Godfrey and Wooten 1981). Riefner and Windler (1979) compare *P. arifolium*, *P. sagittatum* and *P. perfoliatum*. Godfrey and Wooten (1981) list *P. meisnerianum* and *P. sagittatum* as present in Florida. In order to distinguish all four species, N. Coile produced the key given below:

**Key Distinguishing the Prickly *Polygonum* Species in Southeastern U.S.**

- 1. Leaves peltate; ocrea flare into saucer-like structures; perianth surrounding mature achenes metallic-blue ..... *P. perfoliatum*
- 1. Leaves without tissue around petiole junction; ocrea tubular; perianth surrounding mature achenes not metallic-blue.
  - 2. Leaves sessile ..... *P. meisnerianum*
  - 2. Leaves petiolate.
    - 3. Leaves sagittate, prickly on mid-rib below, with pubescent margins ..... *P. sagittatum*
    - 3. Leaves hastate, without prickles below, pubescent on both surfaces ..... *P. arifolium*

Radford *et al.* (1964) state that *P. sagittatum* is "Often a noxious weed." Plants grow into a tangled mass in creek bottomlands and the unwary and unprotected (N. Coile) can earn abrasions on ankles. If grasped carelessly, the skin on thumbs can also be torn.

**BIOLOGY:** Although an annual in Pennsylvania, if *P. perfoliatum* enters Florida, plants might become perennial. The native *P. hydropiperoides* Michaux, with a range from Nova Scotia to British Columbia and throughout most of the U.S., is an annual in the cooler parts of its range and perennial in the warmer parts (Tarver *et al.* 1986). The weather of the native region of mile-a-minute is relatively wet and warm, similar to the weather of much of Florida.



In the US, the present distribution of *P. perfoliatum* is in temperate regions, but the weed's sub-tropical to tropical origins and its spread southward give cause for alarm. If subjected to Panetta's homocline analysis and the computer program BIOCLIM, the potential range in the US for this exotic species could be predicted more authoritatively (Panetta and Dodd 1987; Panetta and Mitchell 1991); however, this has not yet been done.

In Pennsylvania, seedlings of *P. perfoliatum* are established by late April and fruits ripen from September to November (Hill *et al.* 1981). The fleshy-covered fruits are suitable for dispersal by birds and rodents (Mountain 1989). The late ripening of the fruits makes the scenario of long distance dispersal likely to occur southward because of the fall migration of seed and fruit-eating birds such as puddle ducks, marsh waders (rails, etc.), sparrows and finches (F. Mead, personal communication). Also, since seeds are carried downstream in rivers and streams, especially during flooding, the site in West Virginia along the Ohio River could be critical to dispersal throughout many new areas (R. Young, personal communication).

Mile-a-minute weed has been found on roadsides, edges of woods, nurseries, wood piles, fallow fields, clearings, moist thickets, and ditches (Mountain 1989). Weeds commonly inhabit such disturbed areas. However, this weed is also found in natural areas such as low meadows, stream banks and sites with abundant litter. Riefner and Windler (1979) state that *P. perfoliatum* prefers moist, well-drained habitats. While there is some tolerance to shade, growth is best in sunny locations (Mountain 1989). *Polygonum perfoliatum* will grow in either pines or hardwoods where the canopy cover is less than 60%, but prefers openings in the forest (Johnson, personal communication).

*Polygonum perfoliatum* is sensitive to freezing. The first hard frost of the season can kill the plants (F. Johnson, personal communication). Since the plants in temperate climates do not root at the nodes, nor have a persistent rootstock, new plants must be recruited by germination.

Preliminary studies by Wilbur Mountain (personal communication), using a refrigerator and greenhouse experiments, indicate that cool and moist treatment is required for germination of *P. perfoliatum* seeds. However, Fagan Johnson (personal communication) states that when the seeds are scarified, they will respond to a wider temperature range. Ingestion of seeds by animals can scarify the seeds; birds migrating southward could transport seeds that are more likely to germinate than those left behind and unscarified. Johnson also notes that when seeds are stratified, germination seems to be less successful when temperatures are above 20° C. Stratification involves placing seeds in moist material and storing the seeds at low temperatures in order to break dormancy of seeds. His seed bank studies indicate that the seeds are extremely durable, with 99% of those that did not germinate still viable (indicated by a positive test with tetrazolium blue for live cells).

If cool temperatures are indeed required for germination, then central and south Florida may not be as threatened by movement of seed. Care must be taken with materials such as soil which might contain seeds exposed to cool temperatures before moving to the deep South. North Florida does receive temperatures that might encourage germination of *P. perfoliatum* seed and, thus, the weed could possibly become a problem in the future.

*Polygonum perfoliatum* thrives where forests are clear-cut for timber. This could lead to serious economic problems for logging companies. Mile-a-minute grows rapidly at about the time young pine seedlings are planted, and then overtops and shades out the small tree seedlings (W. Mountain, and L. McCormick, personal communications).

Rosellini (1991) states that plants form tangled mats that climb over shrubbery and understory trees, shading out herbaceous and woody vegetation beneath. Strong plants such as the native *Sambucus canadensis* L. (elderberry) and *Rubus* spp. (blackberries and other brambles) are overgrown and killed by *P. perfoliatum* (Moul 1948). Even the weedy exotic affliction to natural areas, *Lonicera japonica* Thunb. (honeysuckle), is outcompeted by *P. perfoliatum* (R. Young, and D. Windler, personal communications).

**CONTROL MEASURES:** Eradication of this exotic species is the optimal desired outcome. However, eradication is very difficult, if not impossible, to achieve. We usually speak of "control" or keeping an undesirable species in check so that it is not as severe a problem as if left alone. Zamora *et al.* (1989) suggest the following steps for eradicating recently introduced aliens: early detection and reporting, determination of noxious potential, reliable surveys about current range, understanding of the population biology, and finally, the proper technology for treating the infestation.

The herbicide, glyphosate, has effectively controlled dense stands of *P. perfoliatum* on dry land in some environments (Hill *et al.* 1981), and the aquatic version of this herbicide should be effective in wet areas. In a reforestation clear-cut, a late postemergence application of imazapyr killed the plants (Mountain 1989). Hexazinone was effective for preemergence and postemergence treatments. For preemergence treatment, herbicide must be applied before germination, which starts around 1 April in Pennsylvania and presumably earlier further south. Herbicide recommendations are not yet available for Florida.

Mile-a-minute can be controlled by mowing, or cutting with a scythe (Mountain 1989). This mechanical control must be done before excessive growth and seed set. Removal is practical by rake or hand (gloved) for small horticultural areas. However, avoid leaving seed which can cause future infestations. Remove dead or decaying plant mulch material to lessen favorable sites for seed germination.



Numerous insect species feed on *P. perfoliatum* in Pennsylvania, but they are polyphagous on a number of other hosts (Wheeler and Mengel 1984). No effective biocontrols are known.

N. L. Hartwig (quoted by Rosellini 1991) sums up the concerns of many: "If we ignore its presence, we may be creating conditions for full-fledged spread and infestation."

#### ACKNOWLEDGMENTS:

We appreciate the valuable input of many persons, including W.L. Mountain, Pennsylvania Department of Agriculture, Bureau of Plant Industry; L.H. McCormick and F. Johnson, Forestry Department, Pennsylvania State University; N.L. Hartwig, Agronomy Department, Pennsylvania State University; D.R. Windler, Biology Department, Towson State University, Towson, MD; R.W. Young, USDA APHIS PPQ, Seed Examination Facility, Beltsville, MD; R.G. Westbrooks, USDA APHIS PPQ, Whiteville, NC; G.P. Jubinsky, R.L. Kipker, A.J. Leslie, W. Bartodziej and M.P. Phillips of DEP, Bureau of Aquatic Plant Management; and W.N. Dixon and B.L. Pope of FDACS, Division of Plant Industry.

#### LITERATURE CITED

- Bradley, T.R. 1983. Flowering plant records from northern Virginia. *Virginia Journal of Science* 34: 138.
- Cusick, A.W. 1986. *Polygonum perfoliatum* L. (Polygonaceae): A dangerous new weed in the Ohio River valley. *Ohio Journal of Science* 86: 3-4.
- Cusick, A.W. and M. Ortt. 1987. *Polygonum perfoliatum* L. (Polygonaceae): A significant new weed in the Mississippi drainage. *SIDA* 12: 246-249.
- Duppstadt, W.H. 1981. Additions to the vascular flora of West Virginia. *Castanea* 46: 340-341.
- Gleason, H.A. and A. Cronquist. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. D. Van Nostrand Company, New York, NY. 810 p.
- Gleason, H.A. and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada, 2nd edition. The New York Botanical Garden, Bronx, NY. 910 p.
- Godfrey, R.K. and J.W. Wooten. 1981. Aquatic and wetland plants of southeastern United States, Dicotyledons. University of Georgia Press, Athens, GA. 933 p.
- Guner, A. 1984. A new record for the flora of Turkey, and *Campanula latiloba rizeensis*, a new subspecies from Anatolia. *Candollea* 39: 345-348.
- Hickman, J.C. and C.S. Hickman. 1977. *Polygonum perfoliatum*: a recent Asiatic adventive. *Bartonia* 45: 18-23.
- Hill, R.J., G. Springer, and L.B. Forer. 1981. Mile-a-minute, *Polygonum perfoliatum* L. (Polygonaceae), a new potential orchard and nursery weed. Pennsylvania Department of Agriculture, Bureau of Plant Industry, Regulatory Horticulture, Weed Circular 7(1): 25-28.
- Kahn, M.S. and M.A. Hassan. 1978. Taxonomic studies in the genus *Polygonum* from Bangladesh. *Bangladesh Journal of Botany* 7: 21-32.
- Kartesz, J.T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. 2nd edition, 2 vols. Timber Press, Portland, OR. 1,438 p.
- Moul, E.T. 1948. A dangerous weedy *Polygonum* in Pennsylvania. *Rhodora* 50: 64-66.
- Mountain, W.L. 1989. Mile-a-minute (*Polygonum perfoliatum* L.) update- Distribution, biology, and control suggestions. Pennsylvania Department of Agriculture, Bureau of Plant Industry, Regulatory Horticulture. Weed Circular 15(2): 21-24.
- Ohwi, J. 1965. Flora of Japan. Frederick G. Meyer and Egbert H. Walker (eds.). Smithsonian Institution, Washington, DC. 1,067 p.
- Panetta, F.D. and J. Dodd. 1987. Bioclimatic prediction of the potential distribution of skeletonweed, *Chondrilla juncea* L. in Western Australia. *Journal of Australian Institute of Agricultural Sciences*. 53: 11-16.
- Panetta, F.D. and N.D. Mitchell. 1991. Homocline analysis and the prediction of weediness. *Weed Research* 31: 273-284.
- Radford, A.E., H.E. Ahles and C.R. Bell. 1964. Manual of the vascular flora of the Carolinas. The University of North Carolina Press, Chapel Hill, NC. 1,183 p.
- Reed, C.F. 1977. Economically important foreign weeds, potential problems in the United States. USDA, Agricultural Research Service and Animal and Plant Health Inspection Service, Washington, DC. Agriculture Handbook No. 498. 746 p.
- Reed, C.F. 1979a. *Tracaulon perfoliatum* (L.) Greene in Maryland. *Phytologia* 43: 219-221.
- Reed, C.F. 1979b. Additional notes regarding *Tracaulon perfoliatum* (L.) Greene. *Phytologia* 43: 293.
- Riefner, R.E., Jr. and D.R. Windler. 1979. *Polygonum perfoliatum* L. established in Maryland. *Castanea* 44: 91-93.
- Rosellini, L.M. 1991. Speedy new weed poses threat to reforested lands. Pennsylvania State News, August 19.
- Tarver, D.P., J.A. Rodgers, M.J. Mahler and R.L. Lazor. 1986. Aquatic and wetland plants of Florida. Florida Department of Natural Resources, Bureau of Aquatics Plant Management. Tallahassee, FL. 127 p.
- Wheeler, A.G., Jr. and S.A. Mengel. 1984. Phytophagous insect fauna of *Polygonum perfoliatum*, an Asiatic weed recently introduced to Pennsylvania. *Annals of the Entomological Society of America* 77: 197-202.
- Zamora, D.L., D.C. Thill and R.E. Eplee. 1989. An eradication plan for plant invasions. *Weed Technology* 3: 2-12.